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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-------------------------|-------------|----------------------|---------------------|------------------|
| 10/600,332 | 06/23/2003 | Cheol Hwan Park | P68917US0 | 6589 |
| 136 | 7590 | 02/09/2005 | EXAMINER | |
| JACOBSON HOLMAN PLLC | | | ISAAC, STANETTA D | |
| 400 SEVENTH STREET N.W. | | | | |
| SUITE 600 | | | ART UNIT | PAPER NUMBER |
| WASHINGTON, DC 20004 | | | 2812 | |

DATE MAILED: 02/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

(A)

| | | |
|------------------------------|------------------------|---------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/600,332 | PARK ET AL. |
| | Examiner | Art Unit |
| | Stanetta D. Isaac | 2812 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 28 October 2004.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) 12 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-11 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 23 June 2003 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.


LYNNE A. GURLEY
PRIMARY PATENT EXAMINER
TC 2800, AU 2812

Attachment(s)

| | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>10/28/04</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

This Office Action is in response to the amendment filed on 10/28/04. Currently, claims 1-12 are pending, claims 1-11 have been elected without traverse in the telephone response on 7/16/04, and claim 12 has been withdrawn.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 10/28/04 was filed after the mailing date of the Office Action on 7/28/04. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 112

The amendment to claim 11 was not sufficient to overcome the rejection under 35 USC 112, second paragraph. The rejection has been maintained for reason of record.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is indefinite whether the liner nitride film, in claim 11, is an additional liner nitride film to the liner nitride film mentioned in claim 1 or, whether it is the same liner nitride film. If it is the same liner nitride film, then “a liner nitride film” should be changed to “the liner nitride film” in claim 11 line 3 for proper antecedent basis.

For examination purposes the examiner has considered that the liner nitride film, in claim 11, is the same as that in claim 1.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The rejection of claims 1-4 and 6 under 35 U.S.C. 102(b) as being anticipated by Benedict et al. US Patent 5,763,315 has been maintained for reasons of record.

Benedict discloses the semiconductor method as claimed. See figures 1A-2E, and corresponding text, where Benedict teaches a method for forming a device isolation film, comprising the steps of: (a) sequentially forming a pad oxide film 12 and a pad nitride film 14 on a semiconductor substrate 10; (b) selectively etching the pad nitride film to form a nitride film pattern; (figure 1A, col. 2, lines 51-61) (c) etching the pad oxide film and a predetermined thickness of the semiconductor substrate using the nitride film pattern as a hard mask to form a trench 16; (d) forming a thermal oxide film 18 on the surface of the trench; (e) performing an annealing process under NH₃ atmosphere to form an oxide nitride film on the surface of the

thermal oxide film (col. 3, lines 15-24); (f) forming a liner nitride film on the entire surface (col. 3, lines 52-55); (g) forming an oxide film filling **22** the trench on the entire surface; and (h) performing a planarization process (figure 1f, col.3, lines 43-46).

Pertaining to claim 2, Benedict teaches the method, wherein the step (e) comprises a plasma NH₃ nitridation or a thermal NH₃ nitridation. (Col. 3, lines 15-24)

Pertaining to claim 3, Benedict teaches the method, wherein the step (e) is performed at a temperature ranging from 600 to 900°C. (Col. 3, lines 18-20)

Pertaining to claim 4, Benedict teaches the method, wherein the step (e) is performed at a pressure ranging from 5 mTorr to 200 Torr. (Col. 3, lines 15-24)

Pertaining to claim 6, Benedict teaches the method, wherein the step (f) is performed in a LPCVD furnace or a LPCVD single chamber. (col. 3, lines 52-54)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The rejection of claims 5 and 7-11 under 35 U.S.C. 103(a) as being unpatentable over Benedict et al. US Patent 5,763,315 in view of Hong US Patent 6,255,194 has been maintained for the reasons of record.

Benedict discloses the semiconductor method substantially as claimed. See preceding rejection of claims 1-4 and 6, under 35 U.S.C. 102(b).

However, Benedict fails to show, pertaining to claim 5, whether the liner nitride formation and annealing steps are performed under in-situ, in-chamber, or in cluster conditions; pertaining to claims 7-10, the method wherein the step (f): is performed at a temperature ranging from 600 to 900°C; with a pressure range from 0.1 to 10 Torr; and in addition, using one or more gases selected from the group consisting of SiH₄, SiCl₄, SiH₂Cl₂, NH₃, and N₂, which are silicon and nitrogen source gases, respectively. Furthermore, Benedict fails to show, pertaining to claim 10, the method wherein the supply ratio of nitrogen source gas to silicon source gas is 1:1~20:1. Finally, Benedict fails to show, pertaining to claim 11, the method wherein the step (f) further comprises the step of forming said thermal oxide film on a liner nitride film and performing an additional annealing process.

Hong teaches in figures 1-8 and corresponding text, in a similar trench isolation method using pad oxide and nitride mask, forming a thermal oxide film on a liner nitride film and performing an annealing process. Hong also teaches conventional ranges for temperature, pressure, and selection and ratios of source gas. (Col. 4 lines 52-56, col. 6 lines 15-18)

It would have been obvious to one of ordinary skill in the art to have had steps (e) and (f) be performed under in-situ, in-chamber or cluster condition, pertaining to claim 5, in the method of Benedict, with the motivation that, in order to make the process more efficient and to reduce extraneous contamination and exposure to the atmosphere, in-situ techniques would be desirable. Also, as stated in col. 3 lines 50-66, Benedict teaches the use of an LPCVD process and furnace annealing techniques, which are well known in the art to include performance under in-situ, in-chamber or cluster conditions.

It would have been obvious to one of ordinary skill in the art to incorporate the claimed ranges with regards to temperature, pressure, and the selection and ratios of source gases, pertaining to claims 7-10, in the method of Benedict, based on the combined teaching of Benedict in view of Hong, with the motivation that both methods are performed under the use of conventional techniques, resulting in the formation of the silicon nitride layer, using a LPCVD process. The claimed ranges are considered to be within conventional specifications, especially since no critically has been shown.

It would have been obvious to one of ordinary skill in the art to have incorporated said thermal oxide film on the liner nitride film and then perform an additional annealing process, pertaining to claim 11, in the method of Benedict, according to the teachings of Hong, with the motivation that, as stated in Hong, col. 5, lines 63-67, col. 6, lines 1-45, the second thermal oxide film is used to protect the pad nitride film during a plasma process where it is preferable to perform a thermal process such as a plasma thermal process including NH₃ on the inner walls before filling the trench in order to control the thermal expansion between the filling material and the semiconductor substrate.

Response to Arguments

Applicant's arguments filed 10/28/04 have been fully considered but they are not persuasive.

In response to the Applicant's Remarks, page 6,

Applicant raises the clear issue that Benedict's single oxynitride layer 120 is entirely different from the oxynitride formed in the invention, and the single oxynitride layer 120 in Benedict cannot achieve the effect of the present invention.

The Examiner takes the position that the improved interface characteristic between the oxide film and the liner nitride film is not claimed. Additionally, as stated in col. 2, lines 45-50; col. 4, lines 8-17, Benedict teaches that the oxynitride layer is an improved liner that is an effective barrier against oxygen diffusion and, is resistant to hot phosphoric and hydrofluoric acids.

In response to the Applicant's Remarks, page 7,

Applicant raises the clear issue that the resulting dual oxynitride/oxide liner formed on the thermal oxide liner 18 is entirely different from the structure of the present invention in which the oxide nitride film 120 is formed on the thermal oxide film 116 and then the liner nitride film 118 is formed on the oxide nitride film 120.

The Examiner takes the position that the statement made by Applicant, with regards to the liner nitride film 118 being formed on the oxide nitride film 120 is moot since this limitation is not claimed in step (f). The limitation only calls for "a liner nitride on the entire surface".

In response to the Applicant's Remarks, page 7,

Applicant raises the clear issue that the oxide nitride film 120, is formed by an annealing process using NH₃ on the thermal oxide film 116 and then the liner nitride film is formed by the LPCVD method.

The Examiner takes the position that Benedict clearly teaches an oxide nitride film on the surface of the thermal oxide film where the NH₃ atmosphere is included with a dichlorosilane to

form the oxide nitride film. Whether the film is “a single oxynitride liner or, a dual oxynitride/nitride liner” is ultimately irrelevant since the prior art of record taken in its broadest interpretation meets the claimed limitation.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stanetta D. Isaac whose telephone number is 571-272-1671. The examiner can normally be reached on Monday-Friday 9:30am -6:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2812

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stanetta Isaac
Patent Examiner
January 28, 2005

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